AMENDMENTS TO THE SPECIFICATION

Please amend the paragraph on page 2, lines 4 to 17 as follows:

In component mounting machines for mounting electronic components on boards such as printed circuit boards, a sequence of mounting of object components is optimized for achieving shorter processing time (mounting time). Methods of the optimization often differ with specifications of component mounting machines; however, component mounting machines having a highly productive multiple placement head for sucking a plurality of components in a sucking step and mounting the components on a board have recently been developed ~~with~~ due to a steep increase in demand for electronic equipment such as portable ~~telephone~~ telephones and notebook ~~PC~~ PCs, and new methods of optimizing component mounting sequence that correspond to such high-function component mounting machines have been demanded.

Please amend the paragraph on page 2, line 18 to page 3, line 3 as follows:

Among conventional arts for such a purpose is a component mounting sequence optimizing method that improves an efficiency of suction of a multiple placement head capable of simultaneously sucking a plurality of components and that minimizes a moving amount of the multiple placement head (see Japanese unexamined patent application No. 2002-171097, for example). In accordance with the optimizing method, optimization of a component mounting sequence can be achieved that is suitable for the component mounting machine having the highly productive multiple placement head.

Please amend the paragraph on page 3, lines 4 to 21 as follows:

Flow from suction to mounting of components in the component mounting machine in the component mounting sequence optimizing method will be described with reference to a flowchart of Fig. 11. In a step S1, a plurality of components ~~is~~ are sucked by the multiple placement head from component feeding sections. In a next step S2, the components sucked in the step S1 are conveyed to a recognition section and are then recognized. In a next step S3, one of the sucked components is conveyed to a mounting position. In a next step S4, the component conveyed to the mounting position in the step S3 is mounted onto a board. In a next step S5, a number of components still sucked on the multiple placement head is determined, and the step S3 and the step S4 are then repeated until all the sucked components are mounted. Herein, the step S1 will be referred to as a suction operation, and the step S2 as a recognition operation, the step S3 and the step S4 together as a mounting operation.

Please amend the paragraph on page 3, line 22 to page 4, line 8 as follows:

Since the operations of suction, recognition, and mounting are independent of one another as apparent from Fig. 11, and completion of the last operation precedes initiation of the next operation, a processing time can be therefore determined as a total ~~of~~ length of time required for each of the operations. As for the mounting operation, the processing time is determined by a travel of the multiple placement head in the repetition of the conveyance to the mounting points and the mounting operation. In the conventional art, therefore, a component mounting sequence is determined so as to minimize the moving amount of the multiple placement head.

Please amend the paragraph on page 4, line 24 to page 5, line 8 as follows:

In Fig. 12 is shown a working head in which the head camera is installed. As shown in Fig. 12, the working head 1 has a plurality of component suction nozzles 2 and one head camera 3, which stands by at the left or right end of the working head 1, propels itself along array directions 4 of the component suction nozzles 2, and recognizes a suction status of electronic components held on the component suction nozzles 2. With this configuration, the suction status of the components can be inspected while the components are conveyed by the working head 1.

Please amend the paragraph on page 5, line 9 to page 6, line 3 as follows:

Flow from suction to mounting of components in the component mounting machine in which the head camera 3 is installed will be described with reference to a flowchart of Fig. 13. In a step S11, components are initially sucked by the working head 1 from component feeding sections. In a next step S12, a component fed in the step S11 is conveyed to a mounting position and recognition of the components by the head camera 3 is started. In a next step S13, whether recognition of the component that is to be mounted has been completed or not is determined on the basis of a status of the component recognition and, if not completed, standby in the mounting position lasts until the recognition of the object component is completed. In a next step S14, the component conveyed in the step S12 is mounted on the board. In a next step S15, a number of components held by the working head 1 is determined. Then the step S12 (except the component recognition, which has already been started), the step S13, and the step S14 are repeated until mounting of all the components is completed.

Please amend the paragraph on page 6, lines 4 to 9 as follows:

As is ~~evident~~ evident, particularly from the step S13 shown in Fig. 13, the operations are not independent of one another, and the mounting operation is influenced by the recognition operation. Accordingly, a component mounting sequence that minimizes a travel of the working head 1 is not necessarily an optimal mounting sequence.

Please amend the paragraph on page 6, line 25 to page 7, line 14 as follows:

If a mounting sequence of A → B → C is changed to a mounting sequence of C → B → A on the basis of a reason that a travel of the working head 1 following the latter sequence is shorter than a travel of the same following the former sequence, ~~however,~~ a given length of time is still required for the component recognition for the components A, B, and C though a length of time required for the conveyance of the component C is reduced as shown in Fig. 15. Accordingly, the working head 1 is obliged to postpone starting the mounting of the component C until the component recognition is completed. Such simple determination of the mounting sequence according to amount of travel of the working head 1 may result in worse processing time because of addition of recognition time to the processing time.

Please amend the paragraph on page 7, line 16 as follows:

~~Disclosure Of~~ Summary of the Invention

Please amend the paragraph on page 8, lines 7 to 22 as follows:

According to a first aspect of the invention, a component mounting sequence optimizing method is provided in component mounting with use of a component holding head having a plurality of component holding members and a component image pickup section for capturing images of components held by the component holding members,

the method comprising:

comparing conveyance times required for conveyances of components held by the component holding members to respective mounting positions with recognition times required for recognitions of the components held by the component holding members with the component image pickup section by using the a control device; and

determining a mounting sequence for the components held by the component holding head by the control device on basis of a result of the comparison.

Please amend the paragraph on page 9, lines 7 to 23 as follows:

A component mounting device according to a second aspect of the invention ~~comprising~~ comprises:

a component holding head having a plurality of component holding members;

a component image pickup section configured to capture images of components held by the component holding members, wherein the components are held and mounted by the component holding head; and

a control device configured to make comparison between conveyance times required for conveyances of the components held by the component holding members to respective mounting positions and recognition times required for recognitions of the components held by the component holding members with the component image pickup section and to determine a mounting sequence for the components held by the component holding head on basis of a result of the comparison.

Please amend the paragraph on page 10, line 11 to page 11, line 3 as follows:

According to a third aspect of the invention, a program is provided for making a computer execute a component mounting sequence optimizing method in component mounting with use of a component holding head having a plurality of component holding members and a component image pickup section for capturing images of components held by the component holding members,

the program comprising:

a procedure of making a comparison between conveyance times required for conveyances of the components held by the component holding members to respective mounting positions and recognition times required for recognitions of the components held by the component holding members with the component image pickup section; and

a procedure of determining a mounting sequence for the components held by the component holding head on basis of a result of the comparison.

Please amend the paragraph on page 11, lines 4 to 24 as follows:

A recording medium which can be read by computers, according to a fourth aspect of the invention, is a recording medium in which a program is recorded for making a computer execute a component mounting sequence optimizing method in component mounting with use of a component holding head having a plurality of component holding members and a component image pickup section for capturing images of components held by the component holding members and which can be read by computers,

~~the recording medium which has~~ wherein the program ~~comprising~~ comprises:

a procedure of making comparison between conveyance times required for conveyances of the components held by the component holding members to respective mounting positions and recognition times required for recognitions of the components held by the component holding members with the component image pickup section; and

a procedure of determining a mounting sequence for the components held by the component holding head on basis of a result of the comparison.

Please amend the paragraph on page 12, line 19 as follows:

Brief Description Of The Drawings

Please amend the paragraph on page 14, line 20 as follows:

~~Best Mode for Carrying Out~~ Detailed Description of the Invention

Please amend the paragraph on page 15, lines 12 to 25 as follows:

Fig. 1 is a diagram illustrating a general configuration of an electronic component mounting system 500 having the component mounting device. The electronic component mounting system 500 has a plurality of component mounting devices 100, 200 composing a production line in which electronic components are mounted on circuit boards 20 being conveyed from an upstream side toward a downstream side, and has a component mounting sequence optimizing device 300 that optimizes a mounting sequence for electronic components required on the basis of various kinds of data ~~base~~ at the beginning of production or the like, that downloads mounting data which is obtained by the optimization into the component mounting devices 100, 200, and that thereby adjusts and controls the devices.

Please amend the paragraph on page 21, lines 3 to 12 as follows:

In a step S1002, recognition time for each component in one task is determined on the basis of a position of the suction nozzle 111 that sucks the component and that has been determined in the step S1001 and a standby position of the component recognition camera 116. That is, since a traveling speed of the component recognition camera 116 is fixed, the recognition time required for the image capture can be determined for each component on the basis of a relative position between the component sucked by the nozzle 111 and the component recognition camera 116.

Please amend the paragraph on page 23, lines 8 to 15 as follows:

In a step S2004, a decision is made whether or not a mounting sequence for all the components in one task has been determined ~~is made decision~~. If there exist components for which a mounting sequence has not been determined, the mounting coordinate of the component to be subsequently mounted that has been determined in the step S2003 is used as the current position of the component holding head 112 and the steps S2001, S2002, and S2003 are repeated.

Please amend the paragraph on page 24, line 16 to page 25, line 23 as follows:

Initially, a component that is to be mounted first is determined on basis of the conveyance starting position K of the component holding head 112 and the mounting coordinates P1 to P4 for the components 21. Before mounting of the component, both conveyance of the component to the mounting coordinate and recognition of the component have to be completed. Therefore, comparisons are made between the conveyance times from the conveyance starting position K to the mounting coordinates P1 to P4 for the components 21 and the recognition times determined in the step S1002 for the components 21, and the longer ones are set as the mounting preparation times T for the components 21. The conveyance times to the mounting coordinates P1 to P4 for the components 21 can be determined on the basis of the traveling speed of the component holding head 112 and the relative coordinates between the conveyance starting position K and the mounting locations P1 to P4 for the components 21. The lengths of the conveyance time from the conveyance starting position K to the mounting locations P1 to P4 for the components 21 are represented as T(K, P1), T(K, P2), T(K, P3), and T(K, P4), respectively. Then comparisons are

made among the mounting preparation times T1 to T4 for the components 21 as shown in Fig. 9, and a component with the shortest mounting preparation time T, that is, a component that can be mounted in the shortest time is determined as a component that is to be subsequently mounted. In the example described above, the mounting preparation time T for the component 21-1 is the shortest as shown in Fig. 9, and the component 21-1 is therefore determined as a component that is to be subsequently mounted. Then the mounting position P1 of the component 21-1 is determined as a first mounting point.

Please amend the paragraph on page 25, line 24 to page 26, line 22 as follows:

After that, a second mounting component that is to be secondly mounted is determined on the basis of the first mounting point P1 and the mounting coordinates P2 to P4 for other components 21-2 to 21-4. Lengths of new conveyance time from the first mounting point P1 to the mounting coordinates P2 to P4 for the remainder components 21 are represented as T(P1, P2), T(P1, P3), and T(P1, P4), respectively. In a manner similar to the determination of the first mounting point P1 described above, comparisons are made between the new conveyance times required for movements of the component holding head 112 from the first mounting point P1 to the mounting coordinates P2 to P4 and recognition times. However, since the component 21-1 has already been mounted on the mounting point P1 at this point, therefore the comparisons are made between total times and the recognition times determined in the step S1002. The total times are times that the new conveyance times from the first mounting point P1 to the mounting coordinates P2 to P4, the conveyance time T(K, P1) from the conveyance starting position to the

mounting point P1, and mounting time TM1 required for the mounting of the component 21-1 on the mounting point P1 are totalized. Thus lengths of new mounting preparation times T2(2) to T4(2) for the components 21-2 to 21-4 are determined.